Move to IMPROVE LNG carrier design

A new forward-looking design for a 220,000m^3 capacity liquefied natural gas carrier has emerged as part of the EU-funded IMPROVE project, following a study by STX Europe.

Supported by the European Commission, the three year 'IMPROVE' ship design research project is in its last year in its bid to deliver a rationale for making decisions pertaining to the design, production and operation of three new ship generations.

Coordinated by ANAST, University of Liege, IMPROVE involves 17 partners including shipyards such as Saint-Nazaire's, the French shipyard of STX Europe, and Uljanik shipyard of Croatia, owners Exmar, Grimaldi and Tankerska Plovidba Zadar, the classification society Bureau Veritas, two other universities, two ship design companies, two engineering companies and two software companies, as well as WEGEMT (European Association of Universities in Marine Technology and Related Sciences).

IMPROVE aims to use advanced synthesis and analysis techniques at the earliest stage of the design process, considering structure, production, operational performance, and safety criteria on their current basis. The ship types are new generations of chemical tankers and ro-pax vessels and, as the focus of this article, an innovative concept for a large liquefied natural gas carrier (LNGC).

Over recent years, the Saint-Nazaire shipyard (formerly Chantiers de l'Atlantique), the French part of STX Europe, has designed and built several LNG carriers for different shipowners implementing innovative ideas such as the first diesel-electric dual-fuel LNG carrier. Continuing a long tradition of innovation, the French shipyard proposes once more a new design concept for liquefied natural gas carriers.

The Saint-Nazaire shipyard's designers propose a solution to reduce the need for ballasting in order to prevent biological invasions of marine organisms transported in ballast water and sediment transfer. Moreover, energy and thus money will be saved by decreasing the huge amounts of sea water transported, almost unnecessarily.

As part of the IMPROVE project, STX Europe has been meticulous in addressing a host of vessel attributes that add up to a state of the art ship design for LNG transportation.

These range from ensuring the large cargo carrying capacity within minimum dimensions, the observance of best practice in shipbuilding, high levels of safety, economic feasibility, low maintenance, high crew comfort, and security in terms of environmental protection.

The standard LNGC features, such as a complete double-hull, worldwide trade, speed of 19.5knots or the accommodation quarters in the aft part are maintained. The ship will also feature five membrane cargo tanks, with suitable cofferdams.

The innovative part is a change of the hull shape in combination with an adapted type of propulsion unit. The solution is based on a V-shape hull and pod type propulsion technology to make the need for ballast water unnecessary in good sea way conditions. The special hull form allows a sufficient draught in most loading conditions with a reduced volume of ballast water.

Ballast difference

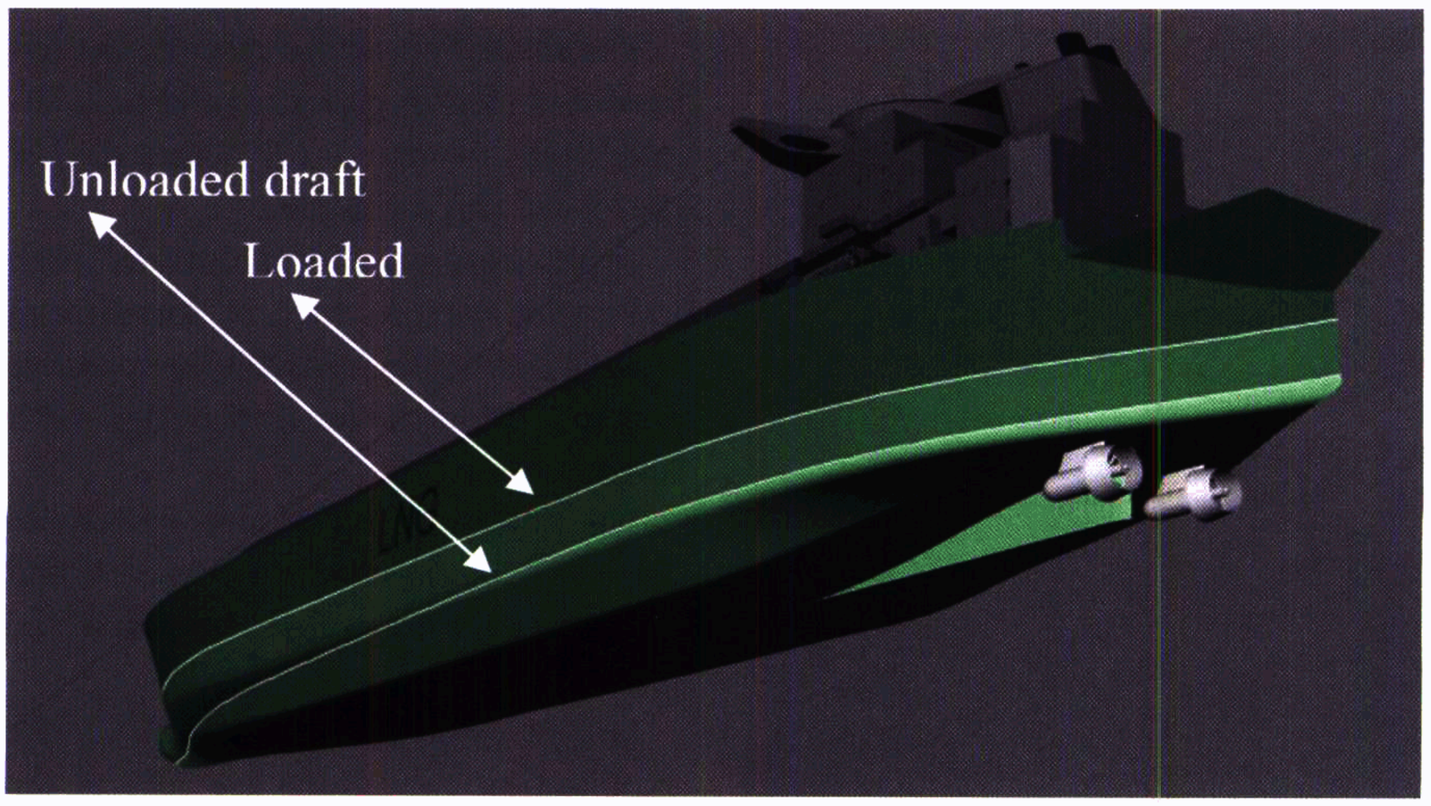
A conventional design for such a LNGC size requires more than 65,000tonnes of ballast water. There are sea water ballast tanks (SWBTs) arranged in the double-hull tanks, forward and aft.

In the STX design, in the unloaded condition, the ship will be able to sail with a minimum volume of sea water, or even with none at all. The use of these SWBTs is in stark contrast to ballast tanks onboard a conventional LNG carrier, where the vessel is either full of LNG with empty SWBTs ("loaded") or empty of LNG with full SWBTs ("unloaded").

The SWBTs may be called upon in two particular situations only:

- Situation 1: during the loading/unloading operations of LNG, to reach a draught to be within the range of the loading arms.
- Situation 2: if the vessel meets bad weather conditions during a voyage and the master wishes to achieve a safer sailing condition from his point of view.

The STX Europe concept suggests a 'two-draught' vessel, using minimal or even no ballast water in the unloaded condition.



TECHNICAL PARTICULARS

STX Europe LNG carrier design

- Length over all ..... about 319.20m
- Length between perpendiculars 309.90m
- Breadth moulded 50.00m
- Depth at main deck 27.40m
- Depth at trunk deck 36.00m
- Design draught (moulded) 13.05m
- Scantling draft 14.10m
- Light ballast draught ..... about 7.00m
- Fully ballasted draught ..... about 9.80m
- Air draft, from B.L. ..... about 59.00m

Total deadweight at design draught ..... about 105,400tonnes

- Cargo total volume (at 100% full and at - 163°C) ..... about 220,340m^3
- Ballast capacity (total volume) ..... about 64,000m^3

- INOVELIS pods ..... two
- INOVELIS pods propeller diameter ..... about 4.50m

- Total output of the four diesel engines (100% MCR) 51,300kW

- Classification ..... Bureau Veritas

Classification, Rules & Regulations
Bureau Veritas I, ✠HULL, ✠MACH, Liquefied Gas Carrier LNG, Unrestricted Navigation, ✠VeriSTAR-HULL, ✠AUT-UMS, SYS-NEQ1, MONSHAFT, CARGOCONTROL, CLEAN SEA, CLEAN AIR, MANOVR, SDS

Concept for a new LNG carrier from STX Europe.

Whatever the particular situation, the design means that the ship will not have to renew or clean the sea water within the SWBTs when the ship is sailing. In short, this can be envisaged as;

- In the situation 1: used sea water is discharged before departure or in a zone close to the terminal at the beginning of the sailing.
- In the situation 2: the sea water used to reach a safer situation is considered as clean.

Thus the International Maritime Organization (IMO) recommendation to treat the ballast water is fulfilled or respectively not needed.

Machinery

A diesel-electric power station is proposed using engines of four-stroke dual-fuel type (running on boil off gas or marine diesel oil) at 514revs/min. At the start of the project, this thinking was based on the dual fuel engines supplied by Wärtsilä although, since the study began, other dual fuel main engines options have surfaced from MAN Diesel.

For the propulsion itself, two electric engines within two INOVELIS pods developed by CONVERTEAM may be used. Other types of propellers may also be considered, subject to further studies, according to STX Europe.

Cargo containment

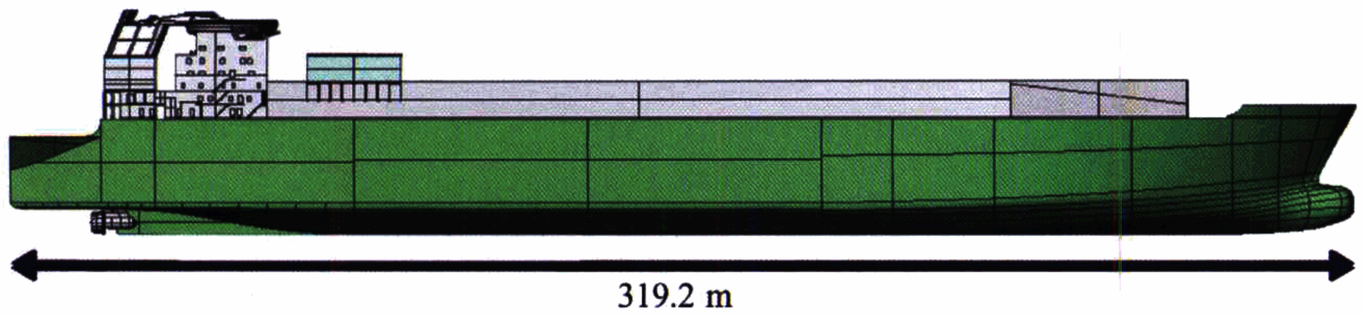
The proposed containment system is of the membrane type, five (5) tanks based on Gaz Transport and Technigaz (GTT) technology. Sloshing problems will be avoided by following the GTT and classification society requirements.

The insulation of the cargo tanks has been designed to give a natural boil-off-rate (BOR) to about 0.135 % (per day) of the loaded cargo volume.

Other containment solutions with independant tanks such as Aluminium Double Barrier Tank (ADBT) are possible and adaptable to the ship design with further studies.

The hull form is designed with more than 80% of developable surfaces, and minimises the cost of production of the hull.

For a conventional LNGC the exploitation conditions are 50% of the



time in a loaded condition and 50% of the time in an unloaded condition. For the STX Europe design, the partition of the exploitation conditions are the same but, within the unloaded condition, 80% of the time only a minimum volume of sea water is required, which may be nil, and the remaining time is considered with full SWBT.

Under such assumptions, around 8.6tonnes of LNG used as fuel can be saved per day. This is equivalent to a 9% saving when compared to a diesel electric dual fuel LNG carrier with about the same size and conventional features.

STX Europe is currently designing other LNGC sizes such as a "medmax" LNGC with the same principle. *NA*

The ship is envisaged with five cargo tanks, offering a large capacity of 220,000m^3, with length limited to 319m.